

THE CLAIMS

What is claimed is:

- 5 1. An apparatus for splitting apart a substrate
 comprising two adjoining wafers defining between them a
 cleavage plane, which comprises:
 means for feeding a plurality of substrates disposed in
 a substrate-storage direction;
10 splitter means comprising moving jaws for splitting
 apart the wafers; and
 means for performing controlled displacement of certain
 wafers after they have been split apart in a direction that
 is substantially parallel to the substrate-storage
15 direction.
2. The apparatus of claim 1, wherein the splitter
 means splits the wafers of the substrates simultaneously.
- 20 3. The apparatus of claim 1, wherein the splitter
 means splits the wafers of the substrates sequentially.
4. The apparatus of claim 1, wherein the means for
 feeding substrates comprises a cradle-type support for
25 holding the substrates and a pusher suitable for moving
 substrates from out of the cradle-type support.
5. The apparatus of claim 1, wherein:
 the splitter means comprises a first jaw-forming comb
30 assembly that includes at least two moving jaws situated on
 either side of a gap for receiving the substrates;
 the jaws are suitable for holding the substrates once
 the jaws have clamped onto the substrates;
 wherein each jaw comprises first and second portions
35 that have corresponding concave housings for receiving and
 holding the substrates; and

wherein the corresponding housings have a shape that is configured and adapted so that once the first and second portions of the two jaws have clamped onto the substrates, the two wafers of each substrate are urged apart by co-operation between the shapes of the housings of the first portions of the two jaws and the second portions of the two jaws, respectively.

6. The apparatus of claim 5, wherein the two moving jaws of the first comb assembly are identical.

7. The apparatus of claim 5, wherein each of the concave housings of the first and second jaw portions of the first comb assembly includes a respective projecting element for engaging a substrate at its cleavage plane, the projecting element defining a general plane in which it extends.

8. The apparatus of claim 7, wherein, in each jaw of the first comb assembly:

each concave housing of the first jaw portion presents a profile that is asymmetrical on either side of the projecting element and that includes:

a first wall oriented at a first general angle of incidence relative to the general plane of the projecting element to co-operate with a first side of the substrate; and

a second wall oriented with a second general angle of incidence relative to the general plane of the projecting element to co-operate with a second side of the substrate, which second angle of incidence is greater than the first general angle of incidence;

wherein during clamping of the first jaw portions of the first comb assembly on the substrate, the wafer of the substrate that is on the first side of the substrate presents a degree of freedom to move relative to the first

portion and in a direction perpendicular to the general plane of the projecting element that is smaller than the degree of freedom to move presented by the substrate wafer which is on the second side of the substrate.

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9. The apparatus of claim 5, wherein, in each jaw of the first comb assembly:

each concave housing of the second jaw portion further presents a profile that is asymmetrical and comprises, on
10 either side of the projecting element:

a first wall oriented with a first general angle of incidence relative to the general plane of the projecting element to co-operate with the second side of the substrate; and

15 a second wall oriented with a second general angle of incidence relative to the general plane of the projecting element to co-operate with the first side of the substrate, which second angle of incidence is greater than the first general angle of incidence;

20 wherein during clamping of the second jaw portions of the first comb assembly on the substrate, the substrate wafer on the second side of the substrate presents a degree of freedom to move relative to the second portions and in the direction perpendicular to the general plane of the
25 projecting element that is smaller than the degree of freedom to move presented by the substrate wafer which is on the first side of the substrate; and

wherein the two wafers are urged apart during clamping of the first comb assembly on the substrate.

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10. The apparatus of claim 5, wherein, in each jaw of the first comb assembly, the first portion comprises two members that are disposed on either side of the second portion.

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11. The apparatus of claim 5, wherein, in each jaw of the first comb assembly, the second portion is movable relative to the first portion.

5 12. The apparatus of claim 5, wherein the means for achieving controlled displacement of certain substrate wafers after they have been split apart comprises means for moving the second portion of each jaw in translation relative to the first portion of each respective jaw in a
10 direction perpendicular to the general plane of the projecting element.

13. The apparatus of claim 5, further comprising a second jaw-forming comb assembly having jaws that can be
15 clamped onto the substrates independently of the first and second portions.

14. The apparatus of claim 13, wherein the second comb assembly further includes a plurality of passages for
20 allowing certain wafers to pass therethrough.

15. The apparatus of claim 13, further comprising three stations, including a first station for receiving at least one substrate to be split apart, and two additional
25 stations, each for receiving a respective wafer from each split-apart substrate.

16. The apparatus of claim 15, wherein the first and second comb assemblies are mounted to move relative to the
30 stations and means are provided for displacing the comb assemblies selectively to be in register with each station.

17. The apparatus of claim 13, wherein each station is provided with a respective pusher.

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18. The apparatus of claim 17, wherein the pusher associated with the first station has housings for receiving the substrates, and the pusher associated with the other stations having housings for receiving respective ones of the wafers obtained by splitting apart each substrate.

19. The apparatus of claim 17, wherein each housing of the pusher associated with the first station further includes a projecting element therein for engaging the substrate at its cleavage plane.

20. The apparatus of claim 1, further comprising:
a separator suitable for movement between a position in which the substrates are disengaged from the separator, and a position in which the substrates are attacked by the separator; and

a first comb comprising at least two moving jaws for taking hold of the substrates after the substrates have been attacked by the separator;

wherein the jaws hold the substrates after being clamped thereon; and

each jaw has spaced apart housings so that once the jaws have been clamped onto the substrates, the wafers of the substrates are spaced apart in the housings.

21. The apparatus of claim 20, wherein the separator has a cross-section in the form of a projecting wedge.

22. The apparatus of claim 20, further comprising at least two stations, including one station dedicated to splitting substrates and one station dedicated to unloading the split-apart wafers.

23. The apparatus of claim 22, wherein each station is provided with a respective pusher.

24. The apparatus of claim 23, wherein the pusher of the station dedicated to splitting substrates has housings for receiving the substrates, which housings in cross section present a generally V-shaped profile.

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25. The apparatus of claim 23, wherein the pusher of the station dedicated to splitting substrates has housings for receiving the substrates, and wherein each housing has a W-shape and a central edge in a bottom portion thereof.

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26. The apparatus of claim 20, which further comprises a second comb at least two moving jaws for clamping the substrates independently of the first and second portions.

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27. The apparatus of claim 26, wherein the second comb further includes a plurality of passages for allowing certain wafers to pass through.

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28. The apparatus of claim 20, further comprising a guide for positioning the substrates in accurate manner therein.

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29. A method of splitting apart a substrate comprising two adjoining wafers defining between them a cleavage plane, which method comprises:

manipulating a plurality of substrates disposed in a substrate-storage direction so as to bring them into registration;

splitting the substrates into wafers; and

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imparting controlled displacement to certain wafers in a direction substantially parallel to the substrate-storage direction..

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30. The method of claim 29, which further comprises handling the wafers in two batches, each batch comprising a

respective wafer from each substrate, and depositing each of the two batches in a respective location.

31. A method of splitting apart a substrate comprising
5 two adjoining wafers defining between them a cleavage plane, which method comprises:

bringing each substrate into a substrate-receiving space; and

10 clamping first and second jaw portions onto each substrate in such a manner as to hold each substrate and urge apart the two wafers of each substrate by co-operation between the shapes of housings in first and second portions of the two jaws, respectively.

15 32. The method of claim 31, wherein during the clamping, co-operation between the shapes of the housings of the first portions of the two jaws also causes controlled offsetting between the two wafers of each substrate in a direction perpendicular to the cleavage plane.

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33. The method of claim 32, wherein splitting occurs during the controlled offsetting.

25 34. The method of claim 31, wherein following the clamping, the first and second jaw portions are loosened so as to release the separated wafers, while other jaws are clamped together so as to retain only certain wafers of the substrate.

30 35. The method of claim 34, wherein one wafer of each substrate is retained, with the other wafer being recovered by a pusher, and for each split substrate the wafers are placed in separate containers.

36. The method of claim 31, wherein the substrates include a zone of weakness between a first SOI wafer and another wafer of semiconductor material.

5 37. A method of splitting apart substrates comprising two adjoining wafers defining between them a cleavage plane, which method comprises:

 bringing each substrate into a substrate-reception space;

10 clamping together separator portions onto each substrate so as to split apart the two wafers of each substrate; and

 clamping the split-apart substrate wafers so as to hold the wafers together.

15 38. The method of claim 37, wherein prior to clamping, the split-apart wafers are held in generally V-shaped housings.

20 39. The method of claim 37, which further comprises holding the substrates by means of a guide prior to splitting the substrates apart.

25 40. The method of claim 37, which further comprises additionally clamping the clamped wafers so that only certain wafers are retained.

30 41. The method of claim 40, which further comprises retaining one wafer of each substrate and recovering the other wafer of each substrate, placing the first split-apart wafer in a first container and placing the second split-apart wafer in a second container.